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Technological Progress in Wireless Communication: An Extensive Analysis

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***Abstract*— Recent years have seen tremendous changes in the information and telecommunications sector, driven by the Internet's explosive growth and improvements in wired and wireless network technologies. The fast expansion of the Internet and advancements in wired and wireless network technologies have led to the emergence of sophisticated multimedia applications that function across distributed systems composed of diverse information servers and network technologies. In order to demonstrate a wide variety of developments, the paper discusses prospective 6G-based applications and emphasizes the fifth generation (5G) of wireless communication technology. While the integration of cellphones into the educational system causes disputes regarding its benefits and drawbacks, the special advantages of mobile social media are examined, particularly in terms of improving quality of life. Different radio access and switching mechanisms, reduced latency, and bandwidth needs are used to trace the development of wireless communication technology. The applications and potential contributions of notable technologies including Bluetooth, Li-Fi, Near Field Communication (NFC), and Radio Frequency Identification (RFID) are highlighted in separate introductions. The fifth generation of Bluetooth is being developed in response to the needs and difficulties of the twenty-first century, and it has the potential to be an ad hoc network technology.**

***Keywords*— Wireless communication, Radio frequency Identification (RFID), Li-Fi, Nanotechnologies, mobile phones, Near Field Communication (NFC), Bluetooth.**

I. INTRODUCTION

The information and telecommunication industry have undergone significant transformations in recent years, driven by the rapid growth of the Internet and advancements in wired and wireless network technologies. This review paper aims to explore the evolving landscape of wireless communication technologies, focusing on key developments and challenges faced by network and service providers. The most basic possible wireless system consists of a transmitter, receiver and a channel, usually a radio link, the information content onto a higher frequency carrier signal at the transmitter, using a process called modulation.

Merely employing a distinct carrier frequency for every radio channel. The original information is recovered at the receiver by the inverse process known as demodulation. [11]

The 5fth generation (5G) of wireless communication technology offers higher data rates, lower latency, increased network capacity, and a better user experience compared its predecessors (3G and 4G). The 5G network includes smart factories, smart cities, smart homes, factual reality, seamless connectivity in self-driving cars, and telemedicine. [2]

FIGURE 1: ENVISIONED 6G BASED APPLICATIONS [1]

The unique benefits of mobile social media can improve quality of life. Smartphone use that is interpersonal builds social capital. The amount of study on the subject of incorporating cell phones into the educational system and the academic learning environment has steadily increased in recent years. The primary debate in this field of study swings back and forth between the advantages and disadvantages of using a smartphone in class. [3]

Evolutions were based on need for more bandwidth, lower latency, radio access and switching schemes. Collectively

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related performance enhancement and parameters like inter channel, interference, compatibility with networks, energy efficiency, connectivity and jitter are need to kept in mind when developing new wireless communication technology. [4]

A new standard for low power, short range wireless communication is called Bluetooth. It is initially intended to be merely a method for replacing wires. The most popular use case for Bluetooth technology is the "cordless computer," which is a collection of multiple devices with a Bluetooth card, such as a laptop, desktop computer, printer, scanner, joystick, printer, and so on. Bluetooth has the potential to be much more than just a technology that replaces wires; in fact, the Bluetooth standard was created with this more ambitious objective in mind. [5]

Mobile phones have become the first choice gadget for every boy or girl. Be it an adult or a teenager. Mobile phone use has now become a status; everyone wants to have the new model of this magic gadget in their hands. Especially the young generation is very interested in new model gadgets. The younger generation loves the latest features offered in the new handset. Likes new ring tones, hello tunes, and wallpapers. Mobile phones with mp3 and video recording facilities, MMS, and internet facilities have attracted more and more youngsters. [6]

Li-Fi is a technology that was introduced first by a German Physicist called Herald Hass from the University of Edinburg. It is a Visible Light Communication (VLC) that deals with the use of LED as light source for the transmission of data at high speed, The technology provided by Li-Fi comes with much larger spectrum for transmission when it is compared with the conventional methods that employ wireless communications that rely on radio waves. The working principle that guides this technology is that data can be transferred through the use of LED light by varying light intensities faster than what the human eyes is able to perceive. [7]

In present days, a new communication technology known as NFC is becoming popular in mobile smart phones. This technology needs two NFC compatible devices placed very near to each other (less than 4cm) in order to communicate, The NFC technology works via magnetic field induction and operates on an unlicensed radio frequency band. Also it includes an embedded energy source component whereas the target can be a RFID card, tag or an NFC device which gives the reply to initiator's request. [8]

RFID technology use automatic data capture system which helps in increasing system efficiency, RFID is rapidly growing technology. RFID offers much advantage over traditional identification device like barcode, RFID has high reading speed and this can work in presence of barrier. This technology is more effective when longer read range, fast scanning and flexible data carrying capability is required.

II. Literature Review

S. Gurumurthy (2009), addressed several recent business and technological trends in the ICT industry and their consequences for performance analysis. They specifically highlighted the following (correlated) trends: modern companies are increasingly relying on performance of ICT systems, services are implemented over multi-domain architectures due to unbundling. The use of wireless communication technologies is rapidly expanding as we move into the 21st century. These technologies include cellular radio, wireless modems, multipoint distribution systems (LMDS), satellite phones, paging systems, cellular radio, personal communication systems (PCS), wireless modems, and local area networks (LANs). [11]

Dahiya M. (2017), has studied that the future wireless communication generation and mobile systems aiming on four prime important issues: switching schemes, bandwidth, data rates, and radio access, also 5G prime evolution challenges and discussed the need for fifth generation. They believe that this Paper will cater need to elevate healthy connect among persons active in various areas creating likely approaches of cellular communication, Internet services, Quality of Service, IP networks and Nanotechnologies. [4]

Singh p., Sharma D. and Agrawal S. (2011), were studied that as many challenges Bluetooth technology faces if it is to succeed as a technology for building adhoc networks and also gives the small description of working area in which the work was done. They identified a number of objectives that any solution should aim at meeting and provided an initial investigation of some of these problems. [5]

Hossain R., Hasan R. and Sharmin M. (2022), studied that the majority of the population is using mobile phones in their daily life for various purposes which varies from for communication, Social Media uses, watching movies, and so on. [6]

Hussain S., Bhadri N. and Hussain Md. (2020), studied that the use of wireless communication technologies, including cellular radio, mobile phones, IOT devices, wireless modems, Wi-Fi, local area networks (LANs), plus multipoint distribution systems (LMDS) for wireless delivery of television internet service is exploding rapidly. Its predicted growth is more than one trillion networked devices in use by 2025. [12]

Dangi R., Lalwani P. and Choudhar G.(2021), covererd a detailed survey on different technologies in 5G, such as massive MIMO, Non-Orthogonal Multiple Access (NOMA), millimeter wave, small cell, MEC (Mobile Edge Computing), beamforming, optimization, and machine learning in 5G. This poll also highlights how crucial it is to develop a flexible, scalable, and dependable 5G network using these recently introduced technologies. [13]

IV. Conclusion

This paper provides a comprehensive overview of the evolving landscape of wireless communication technologies, covering technological advancements, challenges, and the increasing integration of these technologies into various aspects of modern life. The presented literature review synthesizes findings from multiple studies, offering valuable insights into the past, present, and future of wireless communication. The paper also explores the role of mobile social media in improving the quality of life and the increasing integration of smartphones into the educational system. Specific technologies such as Bluetooth, Li-Fi, Near Field Communication (NFC) and Radio Frequency Identification (RFID) are introduced and their applications are outlined.

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